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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/632,948

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James M. Tour

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EXAMINER

SUCH, MATTHEW W

ART UNIT

PAPER NUMBER

2891

MAIL DATE

DELIVERY MODE

05/17/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/632,948

Applicant(s)

TOUR ET AL.

Examiner

Matthew W. Such

Art Unit

2891

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 19 February 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 69-78,85-87,94-96 and 130-135 is/are pending in the application.
- 4a) Of the above claim(s) 74-78,94-96 and 133-135 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 69-73,85-87 and 130-132 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 01 August 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____.

- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 69-72, 130 and 132 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kuekes ('214) in view of Kanayama ('617) in view of Ruoff ('748).
3. Regarding claims 69-71 and 132, Kuekes teaches a process of covalently attaching a molecular wire or molecular switch (Element Rs; Figs. 1a-1b, 8a-8c) to a derivatized fullerene, such as a carbon nanotube (Col. 3, Lines 37-40; Col. 4, Line 64). Kuekes does not teach that the carbon nanotube can be derivatized with a diazonium species.

Kanayama teaches derivatizing fullerenes to covalently attach organic molecules using a diazonium species (Col. 4, Lines 66-67; Col. 5, Lines 1-7). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a diazonium species since the process is highly conventional for those skilled in the art (Kanayama Col. 4, Lines 66-67). Furthermore, the resulting alkyl fullerene has excellent thermal stability and increased solubility in various solvents, making additional chemical processing simpler (Col. 5, Lines 1-7). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a

Art Unit: 2891

single walled carbon nanotube in order to approach the smallest limit of electrical wiring in devices and increase the density of the devices.

Kanayama does not explicitly teach that diazonium species will react with the sidewall of carbon nanotubes, however, Ruoff teaches that the strain energy of the curved surface of fullerenes allows for reaction to occur. The sidewall of carbon nanotubes are bent into a strained configuration on the order of the 2-3 ring diameters Ruoff teaches allows reaction to occur, leaving the sidewall highly reactive. Therefore, some reaction of the diazonium species of Kanayama will occur at the sidewall.

4. Regarding claims 72 and 130, Kuekes further teaches a molecular electronic device connected to the molecular wire (Element Rs; Fig. 8b-10b).

5. Claims 73 and 131 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kuekes ('214) in view of Kanayama ('617) in view of Ruoff ('748) as applied to claims 69 and 71 above, and further in view of Chen (Science).

Kuekes in view of Kanayama does not teach that the molecular wire comprises an oligo (phenylene ethylene) molecule.

Chen teaches using an oligo (phenylene ethylene) molecule in an electronic device. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use an oligo (phenylene ethylene) molecular wire in the process of Kuekes in view of Kanayama since the oligo (phenylene ethylene) exhibits large reversible switching behavior (Chen, first

Art Unit: 2891

paragraph, page 1550) for the memory device of Kuekes in view of Kanayama (Kuekes Abstract).

6. Claims 85-87 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kuekes ('214) in view of Kanayama ('617) in view of Rueckes (Science) in view of Ruoff ('748).

Kuekes teaches forming an assembly with a first plurality of carbon nanotubes (Elements 1-6 in Figures) and a second plurality of carbon nanotubes (Elements a-f in Figures) which can be individually addressed electrically (Col. 3, Lines 37-40; Col. 4, Line 64; Col. 7, Lines 1-3). Functionalized molecular wires and molecular switches are connected to the assembly (Element Rs; Figs. 1a-1b, 8a-8c).

Kuekes teaches immersing the assembly in a chemical species (Col. 9, Lines 35-55). Furthermore, Kuekes teaches that the assembly is reacted electrochemically with the chemical species (Col. 5, Lines 59-67; Col. 6, Lines 1-10; Col. 7, Lines 3-14; Col. 10, Lines 42-59). Kuekes does not explicitly teach that the chemical species can be a diazonium species.

Kanayama teaches derivatizing fullerenes to covalently attach organic molecules using a diazonium species (Col. 4, Lines 66-67; Col. 5, Lines 1-7). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a diazonium species in the chemical species since the process is highly conventional for those skilled in the art (Kanayama Col. 4, Lines 66-67). Furthermore, the resulting alkyl fullerene has excellent thermal stability and increased solubility in various solvents, making additional chemical processing simpler (Col. 5, Lines 1-7).

Kuekes teaches that a negative potential is applied to the assembly (Col. 10, Lines 42-59). However, Kuekes does not teach that applying this negative potential will cause the first plurality to essentially come in contact with the second plurality.

Rueckes teaches a first plurality of carbon nanotubes and a second plurality of carbon nanotubes in an assembly used as a memory device in molecular computing (Fig. 1; Abstract). Furthermore, when a potential is applied across the carbon nanotubes, the first and second pluralities essentially come in contact with each other due to the electrostatic potential between the nanotubes (See Page 96, middle column; Fig. 2B). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have the first and second plurality come into contact in order to produce a strong bistable effect in the memory device (Page 95, right column; Abstract).

Kanayama does not explicitly teach that diazonium species will react with the sidewall of carbon nanotubes, however, Ruoff teaches that the strain energy of the curved surface of fullerenes allows for reaction to occur. The sidewall of carbon nanotubes are bent into a strained configuration on the order of the 2-3 ring diameters Ruoff teaches allows reaction to occur, leaving the sidewall highly reactive. Therefore, some reaction of the diazonium species of Kanayama will occur at the sidewall.

Response to Arguments

7. Applicant's arguments with respect to claims 69-73, 85-87 and 130-132 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure: Yamamoto ('076) and Murphy ('412) teach conventional methods of reacting diazonium species with fullerenes.

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Conclusion

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew W. Such whose telephone number is (571) 272-8895. The examiner can normally be reached on Monday - Friday 9AM-5PM EST.

Art Unit: 2891

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bradley W. Baumeister can be reached on (571) 272-1722. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Matthew W. Such

Examiner

Art Unit 2891


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SUPERVISORY PATENT EXAMINER
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5/10/07